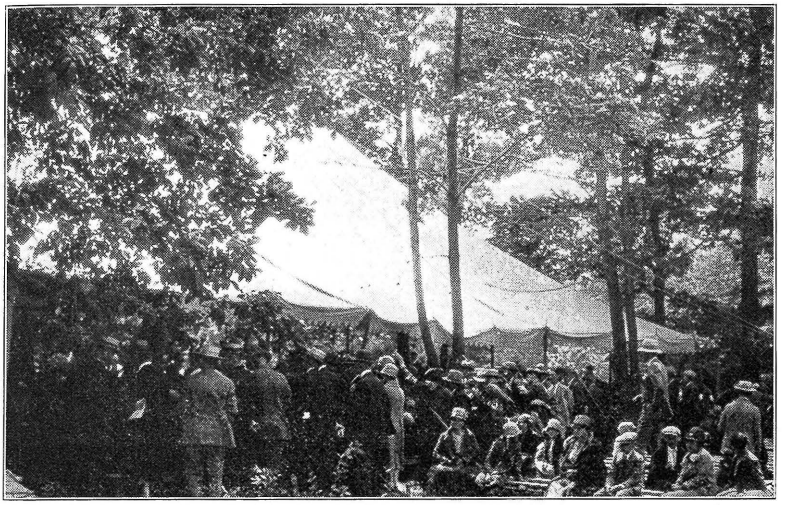
TWELFTH ANNUAL

Ohio Poultry Days

June 28 and 29

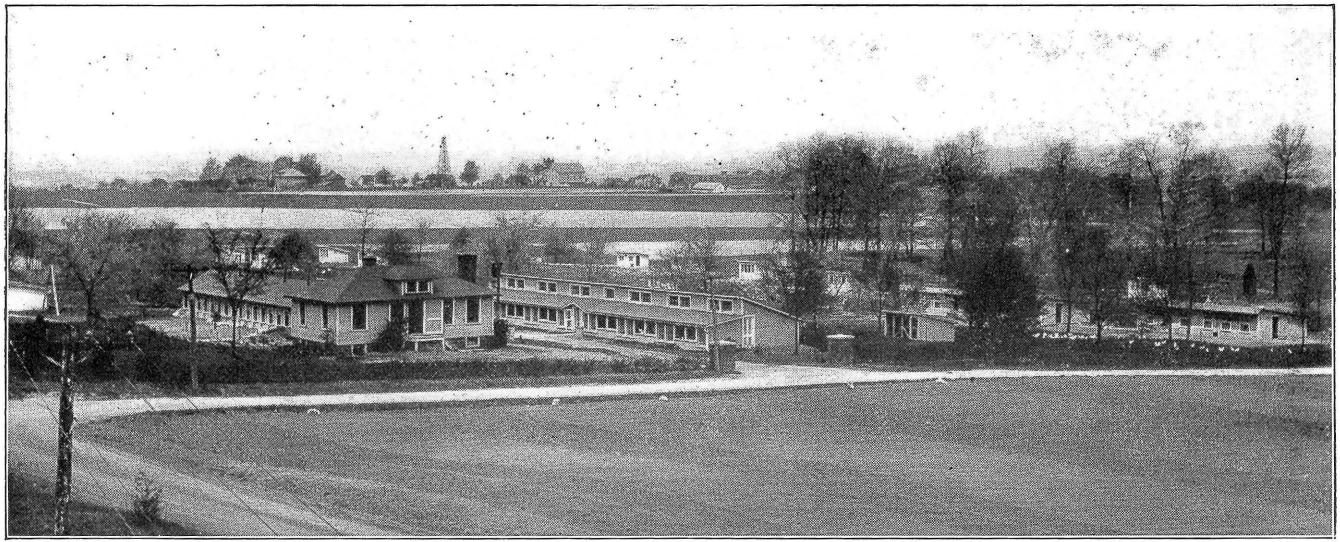
1928



OHIO AGRICULTURAL EXPERIMENT STATION

Wooster, Ohio

Circular No. 11



A portion of the Station's Poultry Plant

PRODUCING HATCHABLE EGGS

R. M. BETHKE AND D. C. KENNARD

New problems are to be faced in connection with the production of hatchable eggs as a result of the phenomenal development of the poultry industry leading to the increased demand for hatching eggs and the consequent intensification of methods of feeding and management of the breeding flocks. We must discover and apply the facts which deal with hatchability in order to proceed intelligently. The urgent need now is for practical information that will enable us to understand, and thereby control, the factors that affect the hatching quality of eggs so as to eliminate the uncertainties of the past.

Poor hatchability has been attributed to the weather and unknown causes or factors over which the poultryman has no control. In light of present knowledge, the hatching quality of eggs depends, not on unknown causes but principally on well established facts pertaining to feeding and management of the breeding flock. Other factors, such as low vitality stock, disease, inbreeding, and incubation may exert an influence that cannot be overcome by proper feeding or management. In the main, however, if 50 or 60 percent of the eggs fail to hatch we must assume that it is due to improper feeding and handling of the flock.

Laboratory tests have shown that a good chick ration must contain not only proteins, fats, and carbohydrates, but certain minerals and vitamins as well. Likewise, the laying hen or pullet will not be an economical producer and lay eggs of good hatching quality, unless she is supplied the essentials with which to maintain her body and produce eggs. A deficient ration fed to a laying flock produces impoverished eggs, which in turn will develop into weak, improperly nourished embryos that may not mature to the hatching stage.

Many poultrymen realize that the hatchability of eggs produced in winter tends to be relatively low, especially if the birds are confined indoors. The reason for this poor hatchability has been commonly supposed to be due to close confinement, lack of exercise, heavy production, etc. Recent investigations, however, have shown conclusively that the low hatchability is not directly due to these causes but to improper nutrition—especially a lack of the antirachitic factor (vitamin D), which is supplied by direct sunlight.

Inasmuch as it is necessary to keep the breeders confined a considerable part of the winter, we are faced with the question of what are the possible substitutes for range that will insure good hatchability.

To secure definite information on the possible nutritional factors that might affect hatchability, the Ohio Station started an extensive series of investigations in the fall of 1924. The first series of experiments consisted of feeding an all-mash control ration of ground yellow corn 30, ground wheat 20, ground oats 20, wheat bran 10, winter wheat middlings 10, and meat scraps 10, supplemented in various ways, to several lots of 50 White Leghorn pullets. Oyster shells were available at all times. All pullets except those having access to a bare lot or bluegrass range were confined indoors where practically all direct sunlight was excluded. Lath bafflers in open front spaces provided the necessary ventilation. The experiment was started November 1. After the respective lots had been on experiment three and one-half months, all eggs available for incubation were set at weekly intervals until the middle of April. The results are summarized in Table 1.

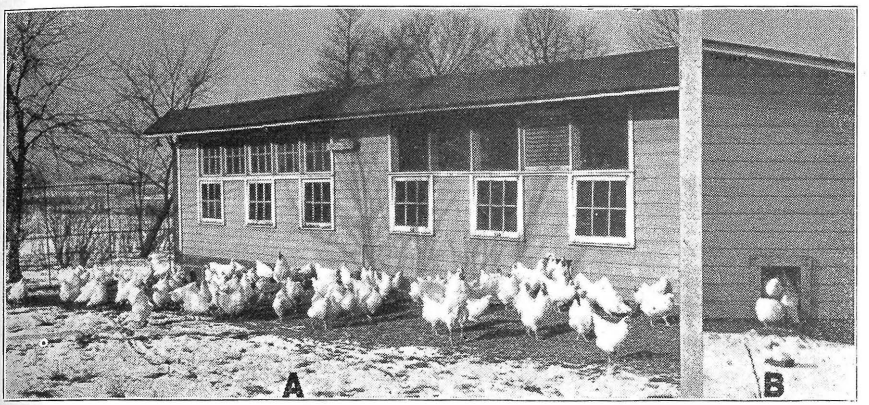
TABLE 1.—Effect of Skimmilk, Alfalfa Hay, Sunlight, Cod-liver Oil, and Range on Hatchability

Ration	Total eggs set	Fertile	Chicks hatched	Fertile eggs hatched	Total eggs set hatched
	No.	*Pct.*	*No.*	*Pct.*	*Pct.*
Basal ration only*.....	1555	93.2	535	36.9	34.4
Basal ration plus skimmilk to drink.....	685	91.2	306	49.0	44.7
Basal ration plus alfalfa hay chopped.....	645	94.0	253	41.7	39.2
Basal ration plus bare outdoor lot.....	345	87.0	118	39.3	34.2
Basal ration plus cod-liver oil, 2%†.....	1110	89.2	341	34.4	30.7
Basal ration plus bluegrass range†.....	1525	94.2	873	60.9	57.2

*Average of three lots. †Average of two lots.

It is evident that the control ration, fed to three separate lots of 50 birds each, failed to meet the requirements of laying pullets confined indoors to produce good quality hatching eggs. The poor hatchability of the control lots cannot be entirely explained upon a vitamin-A or -D deficiency, since cod-liver oil, which furnished both factors, did not exert a beneficial effect on hatchability. Likewise, skimmilk, which exerted a beneficial effect, did not furnish an appreciable amount of the two vitamins to prevent the occurrence of deficiency symptoms noted in the control lots. Some beneficial effects were exerted by alfalfa hay. Direct sunlight, alone, as encountered in the bare lot was of little consequence. Of all the supplements, bluegrass range was by far the best.

In a second experiment with 50 White Leghorn pullets to each lot, the value of various supplements to the basal ration were again determined. Since the control ration in the first trial did not contain sufficient vitamin A to prevent nutritional roup, the control ration of the second experiment was better fortified in this respect by the use of a larger proportion of yellow corn. The ration had the following composition: ground yellow corn 65 parts, ground wheat 20, meat scraps 10, bone meal 4, and salt 1. Oyster shells were kept before the birds at all times. At the same time as much direct sunlight as possible was admitted thru the open front spaces. The reel mash feeders were located in the direct sunlight to afford additional exposure of the birds. The results are shown in Table 2.



A—Direct sunlight promotes health of hens and improves hatchability of eggs. When ground is covered with cinders on south side of house snow and ice disappear soon after the sun shines and hens promptly take advantage of the sunshine.

B—These hens want to come out but the snow prevents.

In spite of the increased amount of vitamin A and the admission of some direct sunlight into the pen, the control ration proved decidedly inferior to the rations fortified with soybean, alfalfa, or clover hay, or blue grass range. The feeding of cod-liver oil again did not improve the hatching qualities of the eggs.

The results thus far indicated that legume hays exert some beneficial effect upon hatchability. However, in absence of direct sunlight (vitamin D) good hatchability could not be expected. This is brought out in comparing the results of the alfalfa-hay lot in trial 1 (Table 1) with the corresponding lot in trial 2 (Table 2) where the windows were kept open as much as possible. The direct sunlight that entered the pen apparently accounted for approximately 15-percent increase in hatchability.

To test out this hypothesis further, several lots of 10 White Leghorn hens each were confined indoors where all sunlight was excluded. They received an all-mash ration of yellow corn 58.5 parts, wheat middlings 15, wheat bran 10, meat scraps 10, bone meal 2, fine oyster shells 4, and salt 0.5. This control ration was supplemented with different amounts of cod-liver oil, alfalfa leaf meal, and a combination of the two.

TABLE 2.—Effect of Soybean, Alfalfa, and Clover Hays, Cod-liver Oil, and Range on Hatchability

Ration	Total eggs set	Fertile	Chicks hatched	Fertile eggs hatched	Total eggs set hatched
	No.	*Pct.*	*No.*	*Pct.*	*Pct.*
Basal ration only*	1187	91.4	387	35.7	32.6
Basal ration plus soybean hay	486	86.4	259	61.7	51.6
Basal ration plus alfalfa hay	1354	94.7	762	59.4	56.3
Basal ration plus clover hay	1026	95.8	568	57.8	55.4
Basal ration plus 2% cod-liver oil	332	93.4	88	28.4	26.5
Basal ration plus bluegrass range	835	78.2	401	64.0	48.0

*Average of two lots.

The data as recorded in Table 3 again clearly demonstrates the failure of the control ration to meet the requirements for good hatchability. The addition of 1 or 3 percent cod-liver oil did not improve the hatching qualities of the eggs, which substantiates the results with cod-liver oil in the two preceding trials. Adding 5 percent of alfalfa leaf meal to the control ration made for some improvement in hatchability but was not nearly as effective as the combination of cod-liver oil and alfalfa meal.

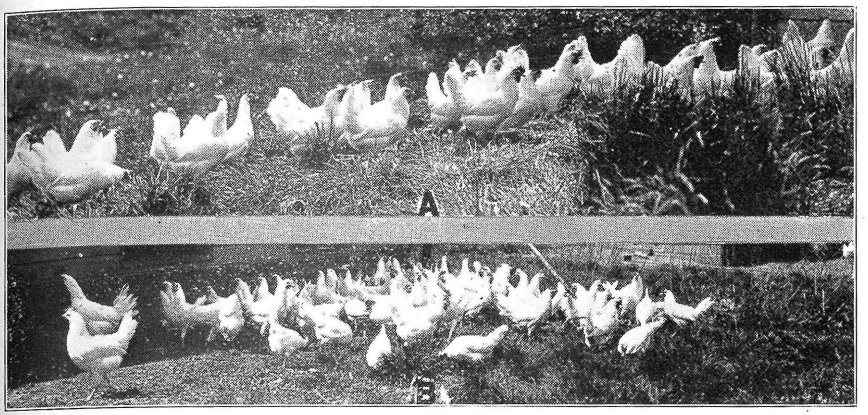
TABLE 3.—Effect of Cod-liver Oil and Alfalfa Meal on Hatchability

Ration	Total eggs set	Fertile	Chicks hatched	Fertile eggs hatched	Total eggs set hatched
	No.	*Pct.*	*No.*	*Pct.*	*Pct.*
Basal ration only	174	92.0	41	25.6	23.6
Basal ration plus 1% cod-liver oil	532	96.8	155	30.1	29.1
Basal ration plus 3% cod-liver oil	285	95.8	77	28.2	27.0
Basal ration plus 5% alfalfa leaf meal	161	90.7	60	41.1	37.3
Basal ration plus 1% cod-liver oil and 5% alfalfa leaf meal	713	94.8	419	62.0	58.8

The mutual supplementing effect of alfalfa leaf meal and cod-liver oil in this trial afforded a possible explanation as to why the eggs of the lot fed a meat-scraps basal ration and having access to a bare lot (direct sunlight) in trial 1 (Table 1) did not hatch better than the control lot, whereas the eggs from birds having access to a bluegrass range maintained good hatchability.

To make certain our claims that a combination of vitamin D, or its equivalent, and alfalfa leaf meal were necessary to insure good

hatchability with a meat-scraps ration fed indoors, a fourth trial was started. This involved the feeding of a meat scraps control ration supplemented with cod-liver oil, cod-liver oil and alfalfa leaf meal, irradiation with ultra-violet light, irradiation and alfalfa leaf meal, and feeding liquid skimmilk in place of water with a similar basal ration without the meat scraps but containing 2 percent of cod-liver oil. The results to April 17 are included in Table 4.



A—September hatched pullets. They make another link in the chain for all the year egg production which is so necessary for special market requirements.

B—January hatched pullets are becoming recognized as profit makers. To produce hatchable eggs in December and January requires special feeding and management.

The data clearly show that a meat-scraps control ration, as used in the several trials, is in itself or with the addition of cod-liver oil or ultra violet irradiation inadequate for producing high quality hatching eggs. The combination of the antirachitic factor as found in potent cod-liver oil, or its equivalent in form of ultra violet light, and alfalfa leaf meal, on the contrary, invariably resulted in improved hatchability.

Milk, on the other hand, when supplemented with cod-liver oil alone will materially improve the hatching qualities of the eggs. Apparently milk and alfalfa leaf meal or good quality legume hays have something in common that increases hatchability when fed in combination with cod-liver oil or when the birds are exposed to direct sunlight.

In conclusion, the interpretation for poultry keepers of the foregoing results and discussion may be briefly summarized to emphasize the fact that good or poor hatchability of eggs is largely

determined by the feeding and management of the breeders. From the foregoing results it is obvious that the nutritional requirements are much more exacting and specific when the breeders are confined indoors, where the caretaker must assume entire responsibility for providing all the requirements, than when the birds are permitted to protect themselves by securing certain vital nutritive factors, especially direct sunlight and green feed from the outdoor range. There is usually no difficulty in securing satisfactory hatchability during the spring months if the breeders have access to a suitable outdoor range. The problem when the breeders are confined indoors for considerable periods, is to provide factors equivalent to those furnished by the outdoor range.

TABLE 4.—Effect of Cod-liver Oil, Irradiation, Alfalfa Meal, and Skimmilk on Hatchability

Ration	Total eggs set	Fertile	Chicks hatched	Fertile eggs set hatched	Total eggs set hatched
	No.	*Pct.*	*No.*	*Pct.*	*Pct.*
Basal ration only*	184	97.3	36	20.1	19.6
Basal ration plus 2% cod-liver oil	252	95.2	59	24.6	23.4
Basal ration plus 2% cod-liver oil and 5% alfalfa leaf meal	250	98.0	144	58.8	57.6
Basal ration plus irradiation	—252	96.0	99	40.9	39.3
Basal ration plus irradiation and 5% alfalfa leaf meal	253	96.8	155	63.3	61.3
Basal ration without meat scraps plus skimmilk ad libitum and 2% cod-liver oil	470	92.3	230	53.0	48.9

*Basal ration:

Yellow corn	58.5
Wheat middlings	15.0
Wheat bran	10.0
Meat scraps	10.0
Bone meal	2.0
Fine oyster shells	4.0
Salt	0.5

The most effective equivalent for green feed seems to be alfalfa, clover, or soybean hay of proper quality. Skimmilk or buttermilk serves as a partial substitute for green feed. To provide the equivalent of direct sunlight the use of a potent cod-liver oil is probably the most effective and the most practical at this time. In a locality where there is considerable sunlight, glass substitutes that admit the ultra violet rays may be used to advantage. Ultra violet light artificially produced is hardly to be considered as practicable as yet.

Finally it should again be emphasized that for good hatchability of eggs neither direct sunlight, potent cod-liver oil, nor ultra violet light proved effective unless supplemented by either green feed, a legume hay, or milk.

TIPPING BEAKS FOR "PICKOUTS"

D. C. KENNARD

Outbreaks of vent picking are of frequent occurrence but seldom do we observe just how it starts or how it all takes place. It was the writer's opportunity recently to observe in considerable detail two typical outbreaks. Perhaps a brief relation of what took place and the measures of control applied may be helpful to others.

Case 1.—The trouble in a flock of 44 White Leghorn pullets started about 1 p. m., February 28, when one of the birds with prolapsus of oviduct was attacked by others of the flock and nearly killed. The trouble was discovered promptly and the bird was removed even before it died. But this proved only the beginning, for the hens had a taste of flesh and blood and their craving for more led them to attack hens with normal vents. Two hours later the birds were found in great commotion attacking each other and three had bleeding vents. In each case examination of these birds showed that the vents were in normal condition before the attack. The upper part of the vent in every case was picked so as to remove a wedge shaped piece of flesh about ⅛ inch deep and as wide as the beak which showed how vicious the attacking birds were. The wounds were bleeding profusely so that a number of other hens were pursuing the victims to get a taste of the blood on the feathers.

Treatment.—Two of the assailants, which seemed to be most vicious and probably the ringleaders most responsible, were caught so as to tip their beaks. This treatment made them harmless. The birds with bleeding vents were given a generous application of pine tar on the wound and surrounding bloody feathers. The tar is healing and repels further attack. This ended the trouble until six days later when one hen was found slightly picked. All that was done at this time was to apply pine tar. No further trouble resulted. Had the outbreak not been handled promptly this flock of birds would have surely suffered disaster.

Case 2.—In a group of 38 White Leghorn hens, at 2 p. m., April 11, one hen was observed plucking feathers very skillfully. She could pluck two to four each time and other hens came rushing to her to share the spoils. Only the one hen seemed to be doing the plucking. Her beak was tipped, rendering her harmless. After-

wards a few other hens made feeble but unsuccessful attempts to pluck feathers. No further evidence of feather picking was observed. Getting the right bird at the right time no doubt averted serious consequences in this case. However, on May 25, a different kind of outbreak occurred similar to Case 1 previously described but of greater intensity. About noon a bird had prolapsus of oviduct and was picked to death. This taste of flesh and blood set the flock on a rampage. Three hours later 3 other birds, with normal vents, were picked to death and 17 others of the flock of 38 hens had bleeding vents from being picked. Thus more than half the flock became victims of cannibalism because of one case of prolapsus of oviduct.

Treatment.—All the birds' beaks were tipped and pine tar applied to the picked vents. There was no further trouble.

Cause.—Because of lack of understanding we are inclined to blame the ration or think that cannibalism is caused from a lack of something in the ration, the need for fresh meat, salt, and so on; but in most cases such are not the real cause. There are many causes for outbreaks of cannibalism. In the epidemics cited the cause was definitely accounted for—a single case of prolapsus of oviduct in each instance. The more familiar we become with the real causes of cannibalism the more effectively we can cope with it. But the prime essential is to keep in close touch with the flock and always to be on the lookout for such outbreaks so as to stop them at the very beginning.

In both cases described the birds were confined indoors but had chopped alfalfa hay. Ten other groups with the same kind of management were kept in the same house. The rations in the two cases varied from the others. The birds in the first case received 5 percent meat scraps in the all-mash mixture; in the second, 20 percent, but these birds had grain, trough-fed, all they would eat, so that the percentage of meat scraps in the total feed consumed was also rather low—between 5 and 7 percent. Whether the low intake of meat scraps and high intake of corn were in any way responsible, we are not prepared to say, altho we doubt it. It seems probable that in each instance the outbreak resulted from a single case of prolapsus of oviduct. This aroused the craving for flesh and blood, which induced the birds to make a general attack. Had they not been started in some such way probably no outbreak would have occurred.

These observations offer an explanation of many cases of "pick outs" or "blow outs" frequently reported. In outbreaks such

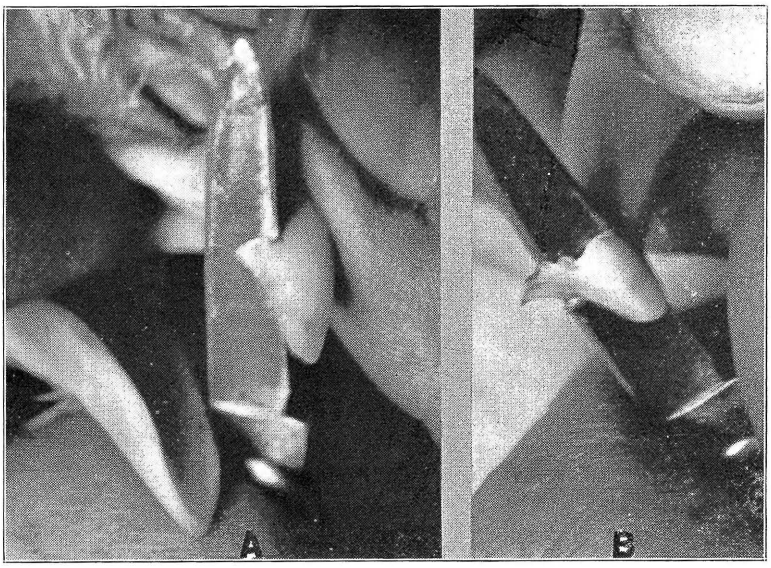
as described, unless the poultry keeper happens to see just what is taking place at a certain time, he will have difficulty in accounting for the trouble. The logical conclusion at a later time may be that there had been a considerable number of cases of prolapsus of oviduct, each the cause of a pickout; whereas there was but one case of prolapsus and the other pickouts were normal birds attacked as a result of cannibalism thus stimulated by the taste of flesh and blood. Furthermore, the caretaker would not be likely to handle all the birds so he would not become aware of the number that had been attacked. He would have very little idea of what had happened or how it took place. The purpose of this article is to aid poultry keepers to a better understanding of how this difficulty takes place and provide them with effective defensive measures.

CONTROL MEASURES

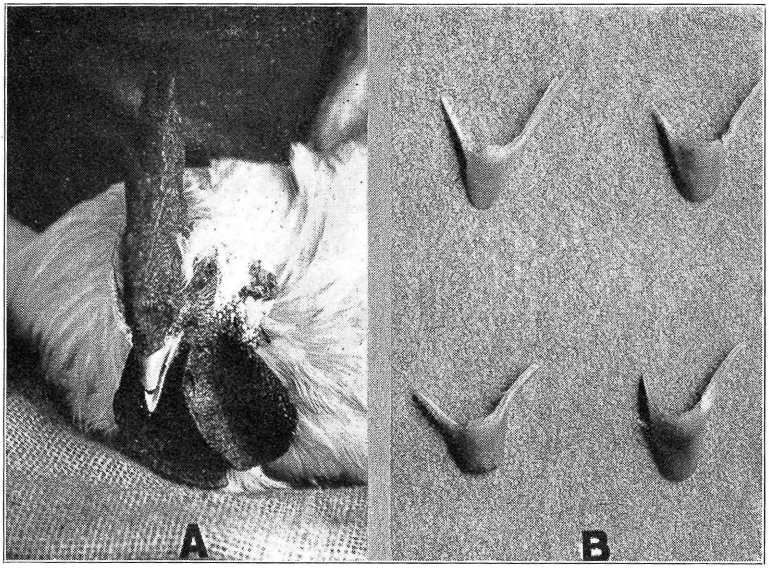
Tipping the beak.—Removal of the tip of the upper beak is undoubtedly most effective for the control of feather pulling and other forms of cannibalism. This treatment renders a bird harmless for a time so far as these vices are concerned. The tip of the beak is removed to the quick so it is tender for a while and leaves it in such shape that it is impossible for a bird to firmly grasp either feathers or flesh. Tipping the beak if properly done involves little pain or discomfort to the bird and seldom causes any bleeding. About three weeks is required for the beak to grow out again. During this time the birds usually forget their past vices and no further trouble results. In some cases where the vice has become chronic subsequent treatments may be required. Tipping the beak appears not to interfere with the bird's eating an all-mash feed or to affect her egg production.

Another effective application of tipping the beak is to prevent male birds from fighting. Fighting often becames a serious matter when it is necessary to put strange male birds together. Many a valuable breeder has been killed or permanently injured in this way. Removal of the point of the upper beak will prevent their fighting for two or three weeks, and in the meantime they become acquainted so that there is little danger of fighting. Should certain birds become troublesome later, the treatment of such individuals should be repeated.

Like most procedures there is a right and wrong way, and in this case the right way is easy and simple and the most effective. By referring to the cut on page 12, it will be seen that there is very little cutting. The edge of upper beak is cut in about ⅛ inch and



A—Showing the first cut at side of beak
B—After a slight prying and pulling against flat side of knife blade the tip of beak is removed



A—Cockerel after removal of tip of upper beak
B—Tips of upper beaks after removal

1/8 to 3/16 inch from the tip, depending on size of beak and length of tip. Then by prying and pulling with flat side of knife the point of beak is removed by tearing and not by cutting. The small cut serves only to get a hold and start the tearing. By tearing the beak it can be removed much closer to the "quick" without bleeding and it is so much easier than paring, even with a razor edged knife. After the tip is torn loose one should pull down toward the lower beak to remove the lower knife edge of the other side opposite where the starting cut was made. This gives the removed tip a V shape and prevents a bird from getting a firm grasp of a feather or flesh. After a little practice beaks can be removed at the rate of 200 to 225 an hour when one has a helper to handle the birds.

FEEDING LEGUME HAY TO CHICKENS

D. C. KENNARD AND GEORGE LINGLE

The best substitute for green feed undoubtedly is a high quality leafy immature cut legume hay, which may be regarded as dried green feed. The Ohio Station's tests during the past four years have yielded highly satisfactory results when the proper quality of alfalfa, red clover, or soybean hay was used for winter green feed. The hays proved as effective as succulent green feed or a bluegrass range for maintenance of health of the flock, egg production, and hatchability.

The dried green feed has the special advantage over the succulent form because it can be fed without interruption during the coldest weather. The chickens like the hay and eat large quantities of it. They even seem to prefer the hay sometimes to the same material in its fresh succulent form. Better results were secured during the last year with the choppd alfalfa hay than with either 5 or 10 percent addition of alfalfa leaf meal to the same mash mixture.

While the feeding of chopped legume hay is rapidly coming into practice the procedure is yet comparatively new. But as soon as they come to realize its value as an essential part of the complete ration required for winter feeding or for flocks confined indoors or on limited range, many poultry keepers will endeavor to have a patch of legume hay to furnish dried green feed for the chickens. They will consider it a fundamental part of the management.

Legume hay of the quality desired for poultry is not usually available on the market. For this reason poultrymen find it necessary to produce their own hay. In the near future when the value of legume hay as a dried green feed becomes more generally recognized and the demand becomes established the desired quality of hay for poultry will no doubt become a standard market commodity in most localities. However, there are today many poultry keepers who are either producing their own hay or who procure a special

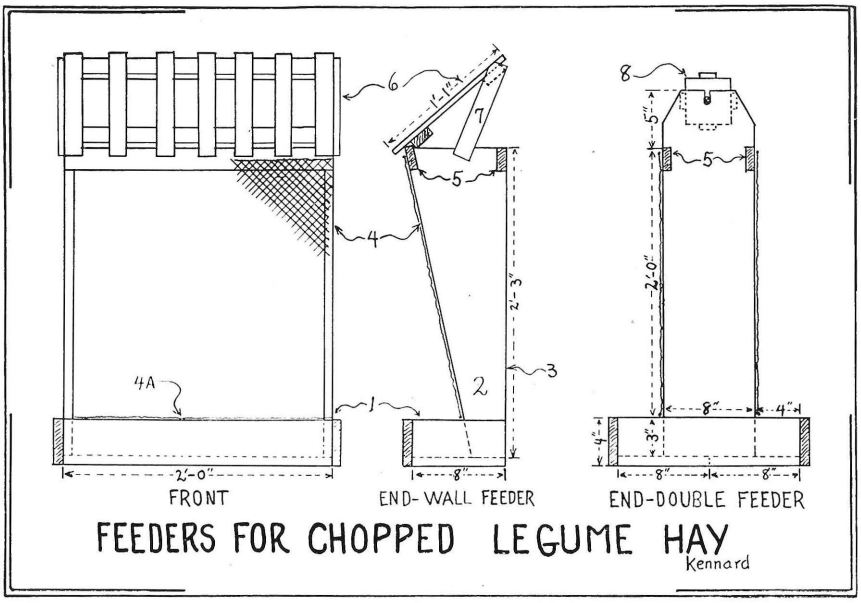


Fig. 1.—1. Bottom receptacle 3 inches deep inside with 4½ inches clearance at top for catching leaf shatterings and prevention of waste.

2. Ends cut diagonally from a 1 by 12 inch board 2 feet 3 inches long so the bottoms are 3 inches wide and the tops 9 inches.
3. Back left open.
4. Front covered with 1 inch mesh poultry neeting 2 feet wide. The netting is placed so the lower side will be even with the top of bottom receptacle—See 4A.
5. Strips 1 by 2 inches on front and back to hold ends in place.
6. Cover made of plaster lath spaced 2 inches apart and nailed to 1 by 2 inch strips to keep fowls out of feeder and prevent roosting. The cover simply sets in place and need not be hinged.
7. Lath on ends of removable cover to keep fowls out.
8. Reel made of plaster lath nailed to 1 by 4 by 4 inch blocks with No. 10 flat headed screws 2½ inches long for axes. The length of reel is ½ inch less than width of box so as to turn freely.

quality of alfalfa hay for this purpose and the Station receives numerous inquiries as to how is the best way to feed it. The most satisfactory way, according to the Ohio Station's tests, seems to be to pass the hay through a clover or silage cutter to cut it in ¼- to ½-inch lengths and feed it in wire netting feeders. Plans for construction of the feeders are shown in Figure 1.

WIRE-NETTING FEEDERS FOR CHOPPED LEGUME HAY

Three different types of feeders have been in use at this Station—the cylindrical form, the wall feeder, and the double feeder. The cylindrical feeder consists of a wire netting cylinder 8 inches in diameter and 24 or 30 inches high, which is attached to a bottom receptacle 16 inches in diameter and 4 inches deep. The cylinder should be strengthened by upright No. 9 wire stays on opposite sides and attached to the bottom and top to keep it from stretching out. The top also needs to be made rigid by a rim of number-9 wire, to which the upright stays are attached.

Later and improved types of feeders have recently been designed by the Ohio Station. The plan and details are given in Fig. 1. For layers the feeders are elevated four inches off the floor, and for chicks they are set on the floor.

In the use of any of the wire netting feeders, the chopped hay should be put in loosely, making no attempt to settle or pack it down, then it will automatically feed down as the birds eat it.

OATS FOR THE LAYERS

D. C. KENNARD AND L. B. NETTLETON

Feeding oats in the laying ration gives rise to two pertinent questions. First what is the value of oats in the ration, and second, which is the best method of feeding it?

Many poultry feeders attach a high traditional value to oats in the ration, but there is a considerable difference of opinion, probably because of a lack of definite information, on this question. When oats is made a part of the ration it usually replaces a corresponding amount of some other grain, usually corn or wheat. The question then is, which benefits the hen more the corn and wheat or oats? The Ohio Station is attempting to find an answer to this question.

Rations containing no oats have been and are being tested against rations otherwise the same but containing oats. Further work will be required to secure conclusive results.

The other question, or which is the best method of feeding oats, is also of interest. A test is now in progress in which 50 White Leghorn pullets in each group are being fed 20 percent oats in five different ways in connection with all-mash rations: 1. Fine ground oats; 2. A corresponding amount of germinated oats; 3. Coarse ground oats; 4. Steel-cut or pin-head oats; 5. Whole oats mixed with the mash. A sixth group receives a similar ration without oats.

The test as yet offers no indications as to probable final results except as to the feeding of whole oats instead of ground oats as a part of the all-mash mixture. The preliminary results suggest that where it is desired to feed oats it is just as well to mix the whole oats in with the mash at the rate of 10 to 20 percent by weight as to go to the trouble and expense of grinding it. This overcomes one of the objections and disadvantages of using oats as an ingredient in the mash because it is difficult to grind. Another advantage of feeding whole oats is that its weight and quality can be readily observed. This is an important point because only high quality, heavy oats should be used in the poultry ration. We are not as yet able to say whether or not grinding the oats enables the fowls to utilize it to better advantage.